

# SUMMARY OF DIAGNOSTIC X RAY IN MEDICINE



NOTES OF MEDADTEAM

- Special thanks to Dr Ashraf Zaki



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NMT 10

## Scheme for X-Ray:

- I. Type.
- II. Part.
- III. Technical Quality:
  1. View.
  2. Centralization.
  3. Penetration.
- IV. Bony Thorax.
- V. Diaphragm.
- VI. Mediastinum.
- VII. Hilum.
- VIII. Heart.
- IX. Lung Field.
- X. Soft Tissue.
- XI. Diagnosis & D.D

### I. TYPE

#### ▪ Possibilities:

1. Plain X-Ray.
2. Barium swallow.

#### • Significance:

- For left atrial enlargement, by the following criteria:
- Indentation on Barium swallow OR
  - Backward Displacement of Barium Swallow



**Diagram 1**

Indentation of Barium swallow in Left Atrial Enlargement



**Diagram 2**

Backward displacement of Barium swallow in Left Atrial Enlargement

### II. PART

#### ▪ Possibilities:

1. Plain CHEST X-Ray.
2. Barium swallows.

### III. TECHNICAL QUALITY

#### 1. VIEW:

##### ▪ Possibilities:

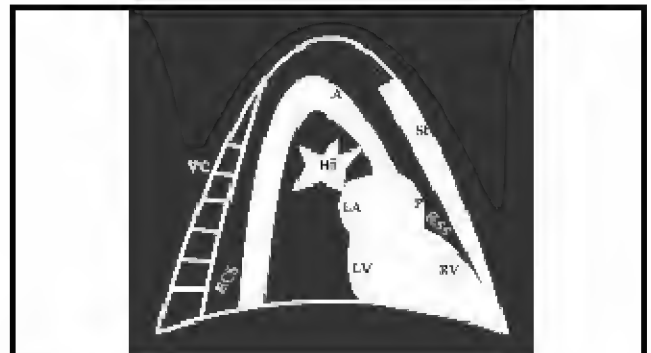
1. Posteroanterior view.

2. Lateral view:

• **Description:** look Diagram

• **Significance:**

- i. Left atrial enlargements in Barium swallow.
- ii. Right ventricular enlargement in Plain Chest X-ray:
  - Normal: Right ventricle occupies  $< 1/3$  of Retrosternal space.
  - Right ventricular enlargement: Obliteration of Retrosternal Space :
    - Suspicious: Rt ventricle obliterates  $> 1/3$  of Retrosternal space.
    - Sure: Rt ventricle obliterates  $> 2/3$  of Retrosternal space.



**Diagram 3**

Normal X-ray Lateral View

St: Sternum

VC: Vertebral Column

Hi: Hilum

RSS: Retrosternal Space

RCS: RetroCardiac Space

RV: Right Ventricle

LV: Left Ventricle

P: Pulmonary Artery

A: Aorta

#### 2. CENTRALIZATION:

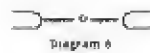
##### ▪ Possibilities:

1. Centralized:

How to know: Dorsal spines are equidistant from medial ends of both clavicles

2. Not Well Centralized:

- **Significance:** Can NOT Comment on Position of Mediastinum.



**Diagram 4**

Right Ventricular Enlargement obliterating retrosternal space

#### 3. PENETRATION:

• **Definition:** visibility of vertebral column through cardiac shadow.

• **Possibilities, How to Know & Significance:**

Table	Penetration		
	How to Know	Possibilities	Significance
Look to vertebral column through cardiac shadow	If vertebral column:		
	-Hardly Seen باين بالعاية	-Normal Penetration.	
	-Clearly Seen باين بوضوح	-Over Penetration.	
	- Not seen مش شافه	-Under Penetration.	-Can NOT Comment on Opacity & Translucency

## IV. BONY THORAX

### ▪ How to differentiate between anterior half & posterior half of Ribs?

Table Differentiate Between Posterior Half & Anterior Half of Ribs

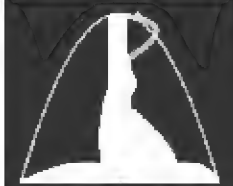
Posterior Half of Ribs	Anterior Half of Ribs	
1. Dense الواضح 2. Horizontal. 3. Reaching Midline.	1. Faint الأقل وضوحا 2. Oblique (45 °). 3. NOT Reaching Midline.	

Diagram 5

#### • Significance:

**Horizontalization** of ribs in emphysema means that **ANTERIOR** Half of RIBS:

- Is the one which is Horizontal (Posterior Half is Normally Horizontal)
- Is **ACTUALLY LESS OBLIQUE** <45°, Not necessarily to be Horizontal with 0° angle

### ▪ How to count:

#### • From posterior half of ribs:

- Start with the highest point on thoracic cage and count
- Note that posterior half of first 2 ribs are close to each other, So take care while counting

#### • From anterior half of ribs:

- Identify posterior half of first rib
- Through reach to anterior half and count

### ▪ Abnormalities, criteria and Significance

Table Abnormalities of bony thorax

Criteria	Abnormalities	Significance
If ribs:		
1. Their anterior half less oblique <45 and widely spaced	<b>Widely spaced horizontal ribs</b>	One of signs of Hyperventilation as in: • Emphysema • Pneumothorax
2. Are overcrowded	<b>Overcrowding of ribs</b>	One of signs of volume loss as: • Collapse • Fibrosis, • Lobectomy
3. Are fractured, in presence of pneumothorax	<b>Fracture of ribs</b>	Search for it in a case of pneumothorax

### 4. Stitches in sternum:

#### ▪ Significance :

- Indicate previous open heart surgery
- So look for artificial heart shadow:
  - If shadow of artificial valve is on that of the vertebral column, so Aortic valve replacement.
  - If shadow of artificial valve is to the left of vertebral column, so Mitral valve replacement.

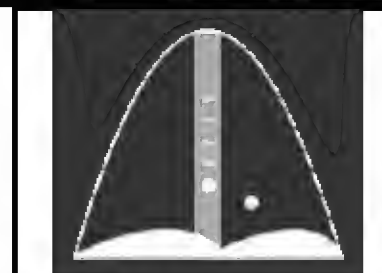


Diagram 6

Stitches in the sternum

1. Aortic valve replacement
2. Mitral Valve replacement

### ▪ Warnings:

- Do NOT mistake first rib concavity as an apical abscess.
- Do NOT mistake shadow of scapula as lung collapse

If there is No abnormality detected on bony thorax, so write 'NAD'

## V. DIAPHRAGM

Comment on five items:

### 1. Border:

▪ **Normal:** sharply well defined, NOT hazy.

▪ **Abnormalities & significance:**

1. **Invisible :** indicating basal homogenous opacity

2. **Hazy:** indicating basal heterogeneous opacity, called Silhouette Sign.

\* **Silhouette Sign of diaphragmatic border:**

-**Definition:** Hazy diaphragmatic border

-**Significance:**

- Indicates basal homogenous opacity which can NOT be differentiated from normal lung vasculature.
- Indicates that this basal opacity is located in LOWER lobe, as opacity in upper lobe makes MEDIASTINAL, not cardiac, border hazy.





**Diagram 7**  
Silhouette sign of diaphragmatic and mediastinal border

### 2. Contour:

▪ **Normal :**

- Convex upwards
- Most convex point on left copula is more lateral than that of right copula

▪ **Abnormalities & significance :**

Table      Abnormalities of the contour of the diaphragm & their significance.		
Abnormalities		Significance
Scalloped or flattened		-Sign of hyperinflation: • Emphysema • Pneumothorax
Tenting		- Sign of fibrosis

### 3. Level:

▪ **Normal :**

If counting from	So diaphragm normally at
Post. Half of 1 <sup>st</sup> rib	10 <sup>th</sup> rib
Ant. Half of 1 <sup>st</sup> rib	5 <sup>th</sup> - 7 <sup>th</sup> rib

## ▪ Abnormalities & significance

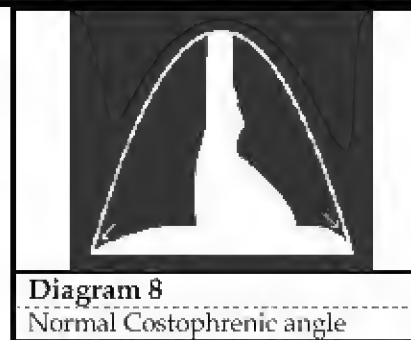
Table 5: Abnormalities of level of diaphragm & their significance.

Abnormalities	Significance
Elevated diaphragm Above 10 <sup>th</sup> post. , above 5 <sup>th</sup> ant.	1.Supradiaphragmatic: · Fibrosis · Collapse 2.Infradiaphragmatic: IAP 3.Diaphragmatic Paralysis: Phrenic N. Injury in open heart surgery (So, Stitches may be present)
Depressed diaphragm Below 10 <sup>th</sup> Post. & Below 7 <sup>th</sup> Ant.	Signs of Hyperinflation: · Emphysema · Pneumothorax

*One sign (either ant. Or post. Counting) is diagnostic for elevation or depression but you must search for both Ant. & Post.to exclude them.*

## 4.Costophrenic angle:

- **Normal:** Costophrenic angle is:
  - Acute
  - Black



## ▪ Concepts to be corrected:

xxx √√√	· ONLY cause of obliteration of Costophrenic angle is pleural effusion. · Pleural effusion is one of the causes of obliterated Costophrenic angle which may be caused also by basal consolidation, collapse or fibrosis.
xxx √√√	· Free Costophrenic angle excludes pleural effusion · At least 500 cc effusions must accumulate to obliterate angle. However, Posterior Costophrenic angle, in lateral view, needs less fluid to be obliterated
NB	· In Transudative effusion, opacity may be NOT that dense and ribs may be seen. HOWEVER, diaphragm is NOT clear & Costophrenic angle is NOT black, so indicates effusion.

## 5.Cardiophrenic angle: look Heart.

If there is no abnormality detected on diaphragm, so say either:

- Diaphragm is of normal border, contour and level with free both Costophrenic angles (*preferable*)
- NAD (*less preferable*)

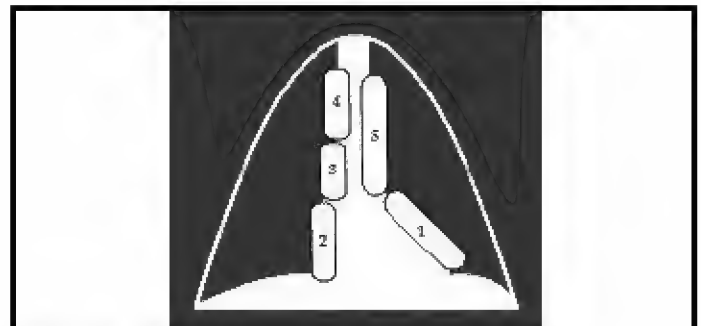


## VI. MEDIASTINUM

Comment on 2 items:

### 1. Border:

- **Normal:** Mediastinal border (border of heart) is **sharply well defined** compared to well aerated lung.
- **Abnormalities:**
  - Hazy Mediastinal border (border of heart): indicates upper (or right middle) lobar heterogenous opacity as:
    - Miliary shadow
    - Fluffy cotton shadow
    - Reticular shadow



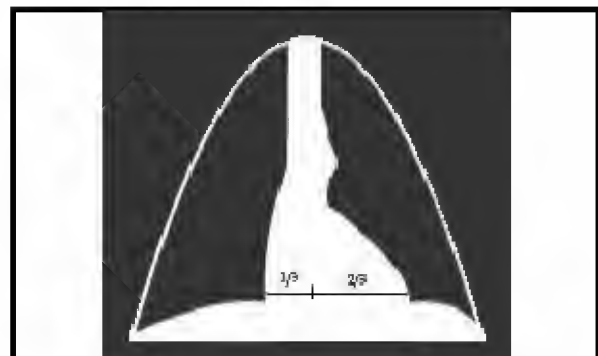
**Diagram 9**

Silhouette sign:

1. Lt lower lobar opacity	Hazy diaphragmatic border
2. Rt lower lobar opacity	
3. Rt middle lobar opacity	Hazy mediastinal border
4. Rt upper lobar opacity	
5. Lt upper lobar opacity	

### 2. Position:

- **Normal:**
  1. **Upper Mediastinum 'Trachea'**
    - Provided the patient is well centralized, Trachea normally is central, deviated maximally by 4mm to right.
  2. **Lower Mediastinum 'heart':**
    - Provided size of heart is normal.
      - 1/3 of heart is to right of midline and
      - 2/3 of heart is to left of midline
- **Abnormalities:**
  - Shift of Mediastinum**
    - **Significance; indicates**
      - Lesion pulling to same side
        - Fibrosis
        - Collapse
      - Lesions pushing to opposite side
        - Effusion
        - Pneumothorax



**Diagram 10**

Normal position of lower mediastinum (heart)

## VII. HILUM

### ▪ Introduction:

- **Definition of hilum: group of structure entering the root of lung:**
  - i. Hilar LNs: invisible except if enlarged or calcified.
  - ii. Main bronchi: invisible except if end on (as rings).
  - iii. Hilar blood vessels.

• **Pulmonary vasculature of lung:**

**I. Central pulmonary blood vessels:**

1. Main pulmonary A.: Located 2<sup>nd</sup> left space when counting from ant. Half of ribs
2. HILAR PULMONARY BLOOD VESSELS:

**II. Peripheral pulmonary blood vessels:**

3. Intrapulmonary vascular marking: Denser in lower zone than upper zone.



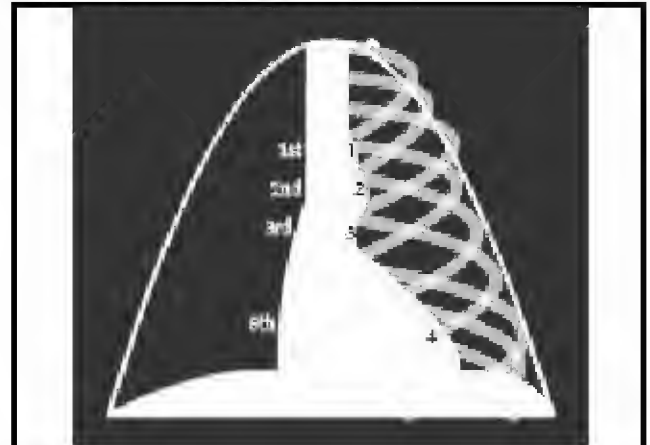
**Diagram 11**

**I. Central pulmonary blood vessels:**

1. Main pulmonary A.
2. HILAR PULMONARY BLOOD VESSELS

**II. Peripheral pulmonary blood vessels:**

3. Intrapulmonary vascular marking



**Diagram 12**

- |                   |                                       |
|-------------------|---------------------------------------|
| 1. Aortic knuckle | at 1 <sup>st</sup> Lt space (convex)  |
| 2. Pulmonary A    | at 2 <sup>nd</sup> Lt space (convex)  |
| 3. Waist of heart | at 3 <sup>rd</sup> Lt space (concave) |
| 4. Apex of heart  | at 5 <sup>th</sup> Lt space (convex)  |

▪ **HILAR BLOOD VESSELS:**

• **Normal criteria:**

**1. Shape:**

- Biconcave.
- Branching tree like.
- If end on, appear as small dots which decrease in size & increase in number on going peripherally  
[unlike Miliary shadows which are of the SAME size & number in all areas]

**2. Diameter:**

- Right main pulmonary A.: 9-16mm.
- Left main pulmonary A.: 9-18mm. X
- Artery/bronchus relation = 1.

**3. Density:**

- Moderate density between heart & lung.

• **Abnormalities:**

**1. Enlarged Hilar Shadow:**

• **Criteria:**

- i. Loss of normal concavity; convex border.
- ii. Increased diameter, if right > 16mm, left > 18mm.
- iii. Artery / bronchus ratio > 1
- iv. Increased density (nearer to that of heart)



- **Significance: Caused by:**

- i. Enlarged Hilar blood vessels:

- Pulmonary hypertension

- Plethora

- ii. Enlarged Hilar LNs.

- iii. Bronchogenic carcinoma (enlarged bronchi)

## **2. Diminished Hilar Shadow:**

- **Criteria:**

- i. If diameter of right & left pulmonary A.  $< 9\text{mm}$

- ii. Artery / bronchus ratio  $< 1$

- iii. Decreased density (nearer to lung field)

- **Significance: Caused by Oligemia as in:**

- Severe pulmonary stenosis.

- Tetralogy of Fallot.

- Pericardial effusion.

**Table** Difference between Plethora, Pulmonary hypertension, Oligemia, Pulmonary congestion according to pulmonary vasculature of lung

	Plethora	Pulmonary hypertension	Oligemia	Pulmonary congestion
In one word	Accentuation of All Pulmonary B.V.	Centralization of pulmonary B.V.	Attenuation of All pulmonary B.V.	Cephalization of intrapulmonary vascular marking
<b>I. Central Pulmonary B.V.:</b>				
1. Main pulmonary Artery:	Increased	Increased	Decreased, so Exaggerated waist	-----
2. Hilar Pulmonary B.V.	Increased i. Convex border ii. Diameter: - Rt. > 16mm - Lt. > 18mm iii. A/B > 1 iv. ↑ Density	Increased i. Convex border ii. Diameter: - Rt. > 16mm - Lt. > 18mm iii. A/B > 1 iv. ↑ Density	Decreased i. Diameter < 9mm ii. A/B < 1 iii. ↓ Density	-----
<b>II. Peripheral Pulmonary B.V.:</b>				
3. Intra-pulmonary vascular markings	Increased	Decreased - Peripheral lung Oligemia. - Attenuation of IP vascular markings. - Proning of pulmonary B.V.	Decreased	Stage1: Upper zone = lower zone. Stage2: Upper zone > Lower zone Moustache sign Stage3: Ground glass appearance المبيضة Lung Stage4: Bat Wing appearance

Diagram



Diagram 13



Diagram 14

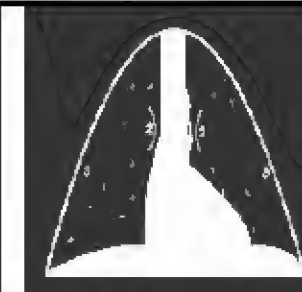


Diagram 15

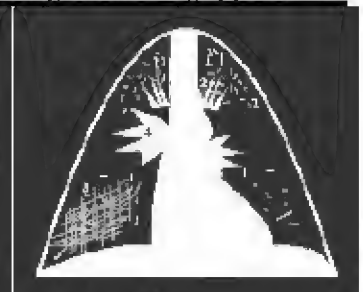


Diagram 16

### • Enlarged Hilar LNs:

- Hilum is Lobulated & Festooned shaped
- Bilateral, caused by:
  - Sarcoidosis.
  - TB.
  - Lymphoma.
  - Leukemia.

### • Bronchogenic Carcinoma:

- Unilateral Hilar enlargement or Coin shadow, To Confirm, Look at Lateral view, Shadow arises from hilum.



Diagram 17  
Bilateral festooned hilum

## VIII. Heart

### 1. Cardio-thoracic ratio:

#### ▪ Criteria:

- Compare between size of cardiac shadow & size of hemithorax  
→ Normal cardiothoracic ratio: Cardiac shadow represents 50 % of hemithorax

#### ▪ Significance:

- **Causes of increased cardiothoracic ratio:**
  - Cardiomegally
  - Pericardial effusion
  - Cardiac aneurysm
- **Causes of decreased cardiothoracic ratio:**
  - Emphysema (ribbon shaped heart in COPD)
  - Constrictive pericarditis

### 2. PERICARDIUM:

#### ▪ Peripheral effusion:

##### • Criteria: Flask-shaped heart:

- Increased Cardiothoracic ratio > 50% of hemithorax.
- Regular smooth borders.
- Lung Oligemia: attenuation of all pulmonary vascular markings.

##### • How to differentiate pericardial effusion from cor bovinum:

Table	How to differentiate pericardial effusion from cor bovinum	
	Pericardial effusion	Cor bovinum
Similarities	1. ↑ CTR.	1. Marked ↑ CTR.
Differences	2. Regular smooth border. 3. LUNG OLIGEMIA: · Attenuation of pulmonary vascular markings.	2. Irregular borders. 3. PULMONARY CONGESTION: · Moustache sign. · Ground glass.
Diagnosis	Pericardial effusion but cor bovinum can NOT rolled out.	Cor bovinum but pericardial effusion can Not be rolled out

Diagram

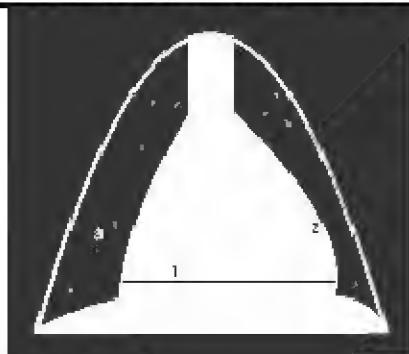


Diagram 18

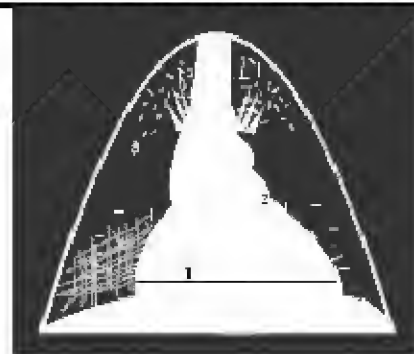


Diagram 19

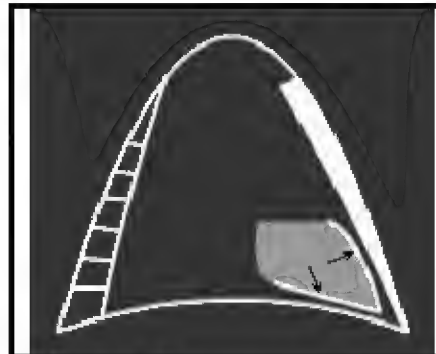
-If:

The cardiac shadow shows increased cardiothoracic ratio with smooth borders (as pericardial effusion) but with pulmonary congestion (as cor bovinum), so diagnosis will be cor bovinum ± pericardial effusion.

▪ **Constrictive pericarditis:**

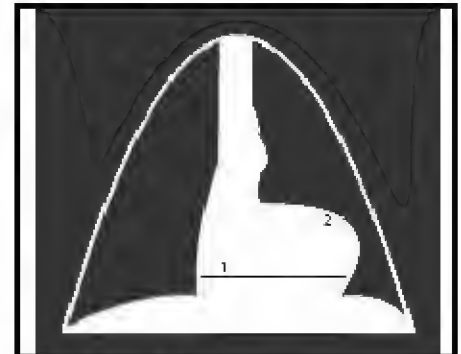
• **Criteria:**

- i. Lateral view.
- ii. **White line sign:** White thick line along the anterior & inferior borders of cardiac shadows.



**Diagram 20**

White line sign in constrictive pericarditis



**Diagram 21**

Ventricular aneurysm

▪ **Ventricular aneurysm:**

• **Criteria:**

- iii. Increase cardiothoracic ratio.
- iv. Shouldering of left border of cardiac shadow.
- v. Oral Question : ttt of ventricular aneurysm is aneurysmectomy

### 3. CHAMBER ENLARGEMENT:

#### A. VENTRICULAR ENLARGEMENT:

Table	Ventricular enlargement in posteroanterior view	
	Left ventricular enlargement	Right ventricular enlargement
<b>Postero-anterior view</b>	<p>• <b>Criteria:</b></p> <ol style="list-style-type: none"> <li>i. ↑ CTR.</li> <li>ii. Shift of apex out &amp; down.</li> <li>iii. Dipping into diaphragm.</li> <li>iv. Obtuse left Cardiophrenic angle.</li> </ol>	<p>• <b>Criteria:</b></p> <ol style="list-style-type: none"> <li>i. ↑ CTR.</li> <li>ii. Shift of apex out.</li> <li>iii. Uplift from diaphragm.</li> <li>iv. Acute Cardiophrenic angle.</li> </ol>
<b>Diagram</b>	<p><b>Diagram 22</b></p>	<p><b>Diagram 23</b></p>

**NB** 1. To Determine shift of apex in ventricular enlargement:

-Determine the anatomical site of apex:

- i. Count ribs from ant. Half of ribs.
- ii. Normal anatomical site of apex lies at MCL at 5<sup>th</sup> left space on counting on ant. Half of ribs.

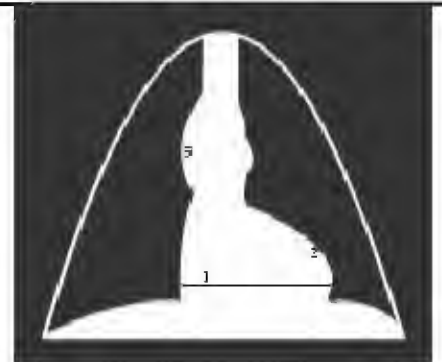
-Compare between anatomical site & actual site of patient's apex & determine its shift.

2. Dipping of diaphragm means: overlap between shadow of heart & diaphragm.

3. Left ventricular hypertrophy:

- Criteria: suspect left ventricular hypertrophy.
  - i. NO increase in cardiothoracic ratio.
  - ii. Apex is full & rounded.
  - iii. Associated aortic dilatation (enlarged upper half of right border of cardiac shadow).

Diagram 24



4. Lt Border of cardiac shadow in RVE is full & rounded as LVH, but in LVH, there is NO increase in cardiothoracic ratio.

Table	Ventricular enlargement in lateral view	
	Left ventricular enlargement	Right ventricular enlargement
Lateral view	<ul style="list-style-type: none"> <li>• Criteria:</li> <li>Obliteration of <b>Retrocardiac space</b>. (&gt; 18mm.)</li> </ul>	<ul style="list-style-type: none"> <li>• Criteria:</li> <li>Obliteration of <b>Retrosternal space</b>.               <ul style="list-style-type: none"> <li>- If obliterated &gt; 30%: suspicious.</li> <li>- If obliterated &gt; 50%: sure.</li> </ul> </li> </ul>
Diagram	<p>Diagram 25</p>	<p>Diagram 26</p>

NB

1. Right ventricular hypertrophy:


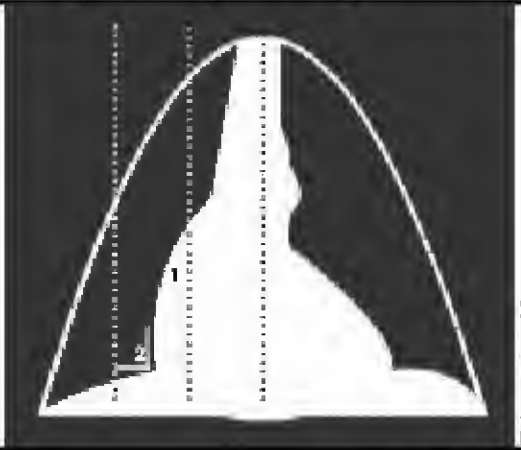
In RVH, there is No increase in cardiothoracic ratio but there are (to suspect RVH):

- i. Pulmonary stenosis; Known by post stenotic dilation.
- ii. Pulmonary hypertension; Known by post stenotic peripheral pruning.

2. Biventricular enlargement: Known by:

- i. Shift of apex out & down (for left ventricular enlargement).
- ii. Pulmonary stenosis & hypertension (for right ventricular enlargement).

## B. ATRIAL ENLARGEMENT:

Table	Atrial enlargement, posteroanterior and lateral view	
	Left atrial enlargement	Right atrial enlargement
Postero-anterior view	<b>•Criteria:</b> <ol style="list-style-type: none"> <li>Mitralization (Quadruple contour):               <ul style="list-style-type: none"> <li>Obliteration or bulging of waist (NORMALLY, waist is concave).</li> </ul> </li> <li>Double contour on right border of cardiac shadow (bulging of right borders).</li> <li>± Elevation of left main bronchus (double contour on left border of cardiac shadow due to left lower lobar collapse).</li> <li>Right Cardiophrenic angle is ACUTE.</li> </ol>	<b>•Criteria:</b> <ol style="list-style-type: none"> <li>Right border of cardiac shadow exceed <math>&gt;1/3</math> of right hemithorax.</li> <li>Right Cardiophrenic angle is RIGHT (<math>90^\circ</math>).</li> </ol>
Diagram	 <p>Diagram 27</p>	 <p>Diagram 28</p>
Lateral view	<b>• Criteria:</b> <ol style="list-style-type: none"> <li>Indentation of barium swallow, look Diagram 1.</li> <li>Backward displacements of barium swallow, Look Diagram 2.</li> </ol>	

**NB** In case of bulging of right border of cardiac shadow, if the right Cardiophrenic angle is:

- Acute, so Huge Left atrial enlargement.
- Right, so Right atrial enlargement.

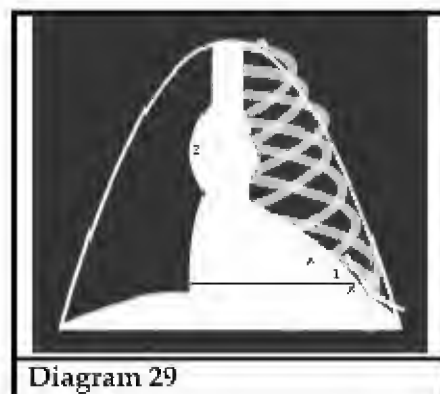
## 4.GREAT VESSELS:

### A. AORTA:

#### ▪ Aortic configuration:

##### • Criteria:

- Aortic Dilatation: bulge of upper half of right border of cardiac shadow.
- Associated left ventricular enlargement.





### Aortic configuration

- **Significance:** indicates:

- Aortic regurge.
- Aortic stenosis associated with left ventricular failure.
- Aortic Coarctation associated with left ventricular failure.
- Hypertension associated with left ventricular failure.

- **Aortic dilatation:**

- **Criteria:**

- Bulge of upper half of right border of cardiac shadow.
- NOT associated with left ventricular enlargement.

- **Significance:** Indicates post-stenotic dilatation.

- **Aortic aneurysm**



Diagram 30  
Aortic aneurysm

### B. Pulmonary vessels: see before.

## 5. VALVES:

- **Calcification of valves and artificial valves:**

Table	Calcification of valves and artificial valves	
	Aortic valve	Mitral valve
	Calcified and artificial valves appear as hyperdense shadow.	
Postero-anterior view	On vertebral shadow	To left of vertebral shadow
Lateral view	Draw a line from ant. Costophrenic angle to hilum Above the line	Below the line

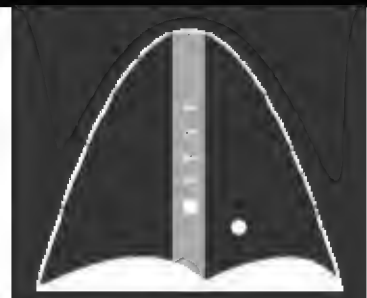


Diagram 31



Diagram 32

- **Pace maker:** appears as a shadow outside chest cage.

## IX. Lung Field

### ▪ Normal Lung field:

-Black field with white intrapulmonary vascular markings. سودة وعليها نغابيش بيضاء.

### ▪ Abnormal Lung field:

Table	Abnormal lung field	
TOO BLACK (HYPERRADIOLUCENCY)	TOO WHITE ( OPACITY)	
	Heterogenous	Homogenous
1. Pneumothorax.	1. Linear.	1. Total Lung.
2. Emphysema.	2. Nodular (Miliary).	2. Lobe.
	3. Reticulonodular.	3. Coin.
	4. Fluffy Cotton.	4. Wedge.
	5. Ring shadow.	5. Obliterating Costophrenic angle.
		6. With fluid level.

### ➤ TOO BLACK ( Hyper-radiolucency):

#### 1. Pneumothorax: Key word is JET BLACK.

##### ▪ Criteria:

A. **JET BLACK:** Complete absence of intrapulmonary vascular markings.

##### • How to elicit?

-Compare apart of a lung field away from bone with mirror part on the other side.

#### B. Signs of Hyperinflation (Unilateral):

- Pushing Trachea.
- Pushing cardiac Shadow.
- Unilaterally Depressing Diaphragm (Scalloped or flattened)
  - Below 7<sup>th</sup> ant. Half of ribs.
  - Below 10<sup>th</sup> Post. Half of ribs.
- Horizontal ant. Half of ribs ( $\downarrow$  Obliquity  $< 45^\circ$ ) with widened spaces.
- Collapsed lung: White mass at hilum.



Diagram 33

##### Pneumothorax

- |                                     |                       |
|-------------------------------------|-----------------------|
| 1. JET BLACK                        | 5. Horizontal ribs    |
| 2. Pushing trachea                  | 6. Lung collapse      |
| 3. Pushing cardiac shadow           | 7. Fracture rib       |
| 4. Unilaterally depressed diaphragm | 8. Surgical emphysema |
|                                     | 9. tube               |

- NB
- **JET BLACK** Does NOT mean that the field should be very dark black, Sometimes the field may be slightly light not very dark, but the most important is absence of intrapulmonary vascular markings completely.
  - Collapsed lung in Pneumothorax may be mistaken as cardiomegally. However, **JET BLACK** lung field confirms collapse of lung.

#### C. Associated Signs:

- Signs of etiology: Fracture ribs.

## ii. Signs of Complications:

-Surgical emphysema: air at chest wall. -Hemopneumothorax: with fluid level.

## iii. Signs of treatment: Tube.

**2. Emphysema: key word is BILATERAL DEPRESSED DIAPHRAGM.**▪ **Criteria:****A. Bilateral Hyperradiolucency (Too Black Lung field).**

± Emphysematous Bulla: Too Black ring with white linear wall.

**B. Signs of Hyperinflation (Bilateral):**

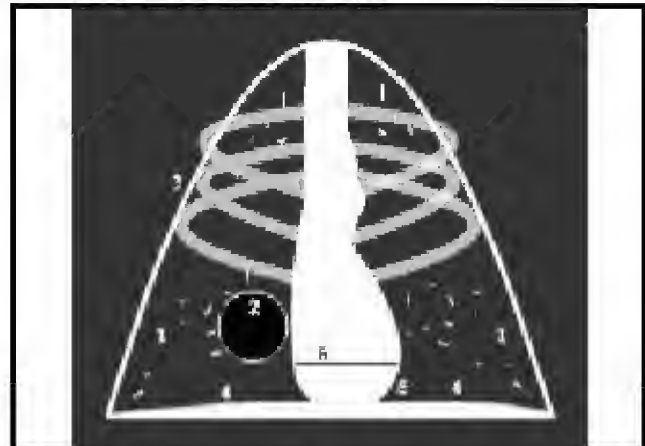
i. Horizontal ant. Half of ribs ( $\downarrow$  Obliquity  $< 45^\circ$ ) with wide spaces.

ii. **BILATERAL DEPRESSED FLATTENED DIAPHRAGM**

iii. Air cushion under cardiac apex (Swing on wind):

Cardiac apex is just touching the diaphragm.

iv. Ribbon Shaped Heart: Decreased Cardiothoracic ratio.



**Diagram 34**

**Emphysema**

- |                        |  |
|------------------------|--|
| 1. Hyperradiolucency   | 4. Bilateral depressed flattened diaphragm |
| 2. Emphysematous bulla | 5. Air cushion under apex                  |
| 3. Horizontal ribs     | 6. Ribbon shaped heart                     |

**C. Associated signs that may or may NOT be present:**

i. Bronchitis: increase Bronchovascular markings.

ii. Signs of Complications:

-Cor-Pulmonale in form of :

- Pulmonary Hypertension:

\* Enlarged Pulmonary A. at 2<sup>nd</sup> Space & Both Right & Left Pulmonary A.

\* Right ventricular enlargement which, if present, will mask Ribbon Shaped Heart

▪ **Exceptions:**

A. Pneumothorax may complicate Emphysema, so its *Jet black* will mask Hyperradiolucency of Emphysema.

B. Cor pulmonale & Right ventricular enlargement may complicate COPD (Emphysema), so the Cardiomegally will mask the *ribbon shaped Heart* of Emphysema.

-So, Key word of **Emphysema** is **BILATERAL DEPRESSED DIAPHRAGM**.

**➤ TOO WHITE (OPACITY):****❖ Two Questions:**

1. What is the Opacity?

2. Where is the Opacity?

-Right or Left.

-Upper lobar, Middle lobar or Lower lobar.

• On PA view: by Silhouette sign.

• On Lateral view: by Fissures.




-Apical (at first 2 ribs), mid zonal (Next 2 ribs), basal (Last 2 ribs).

- Medial or Lateral.

❖ **Homogenous opacity:****1. Total lung opacity:**▪ **Criteria:**

- Homogenous opacity occupying the whole lung field obscuring both Mediastinal & Diaphragmatic borders & obliterating Costophrenic angle.

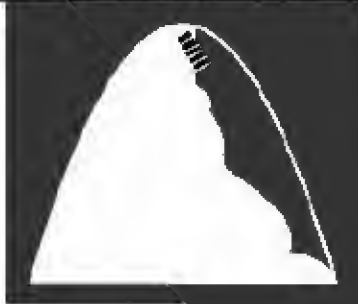

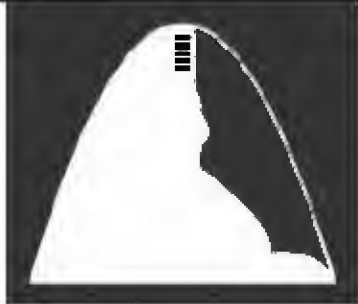
▪ **Scheme for homogenous opacities occupying whole lung field:**

Table DD for homogenous opacity occupying whole lung field.			
Look at the opacity & its relation with Mediastinal & Diaphragmatic border			
Silhouette sign			
Obliterating	both Mediastinal & diaphragmatic borders	Mediastinal border ONLY.	Diaphragmatic border ONLY.
			
	Diagram 35	Diagram 36	Diagram 37
Diagnosis	Total lung opacity	Upper lobar opacity.	Lower lobar opacity.

▪ **Significance:** It indicates either:

- Massive pleural effusion.
- Total lung collapse.
- Total lung consolidation (pneumonia).

▪ **Scheme:**

Table Scheme for total lung opacity			
Look at position of Mediastinum (Trachea & cardiac shadows).			
Mediastinum	Pushed to Opposite side.	Pulled to Same side.	Central
			
	Diagram 38	Diagram 39	Diagram 40
Diagnosis	Massive pleural effusion.	Total lung collapse.	Total lung consolidation

NB	<p>"Total lung opacity with central Mediastinum" have 2 possibilities:</p> <ol style="list-style-type: none"> <li>Total lung consolidation (pneumonia).</li> <li>Massive pleural effusion (pushing Mediastinum) with contralateral collapse (pulling Mediastinum), so Mediastinum remains central.</li> </ol> <p>- It is differentiated by air bronchogram &amp; alveolar edema in case of pneumonia.</p>
----	---

**2. Lobar opacity:** see later

### 3. Coin shadow:

#### ▪ Criteria:

- Patch or patches of homogenous opacity with well defined border, NOT necessarily to be perfectly rounded.
- If  $> 3\text{cm}$ , it is called **Cannon ball**.

#### ▪ Possibilities:

##### • If multiple, so lung metastasis.

Multiple cannon ball opacities in lung field most probably due to lung metastasis.

##### • If single, so possibilities:

###### - Neoplastic:

- i. **Bronchogenic carcinoma:** Have irregular speculated edges.
- ii. Bronchial edema.
- iii. Single metastatic deposit.

###### - Infectious:

- iv. Tuberculosis.
- v. Fungal granuloma.
- vi. Pneumonic stage of lung abscess.

###### - Inflammatory:

- vii. Rheumatic nodule.

###### - Miscellaneous:

- viii. Calcified cyst.
- ix. Interlobar effusion.
- x. Pulmonary infection (end on) [If side on, so wedge].

**Most important cause for coin shadow (unilateral Hilar shadow) is Bronchogenic carcinoma.**



**Diagram 41**

Multiple cannon ball opacities mostly due to lung metastases



**Diagram 42**

Coin shadow (unilateral Hilar shadow) Mostly Bronchogenic carcinoma

### 4. Wedge:

#### ▪ Significance:

##### **Pulmonary infarction:**

- Wedge shaped opacity.
- Pulmonary edema.

#### ▪ Wedge-shaped lesion in lung:

- If wedge-shaped opacity, so pulmonary infarction.
- If wedge-shaped Hyperradiolucency (western mark sign), so pulmonary embolism.



**Diagram 43**

Pulmonary infarction:

- Wedge shaped opacity
- pulmonary edema

## 5. Obliterating Costophrenic angle:

### ▪ Normal Costophrenic angle:

- Black & acute.
- Diaphragmatic border is sharply well-defined.

### ▪ Pleural effusion:

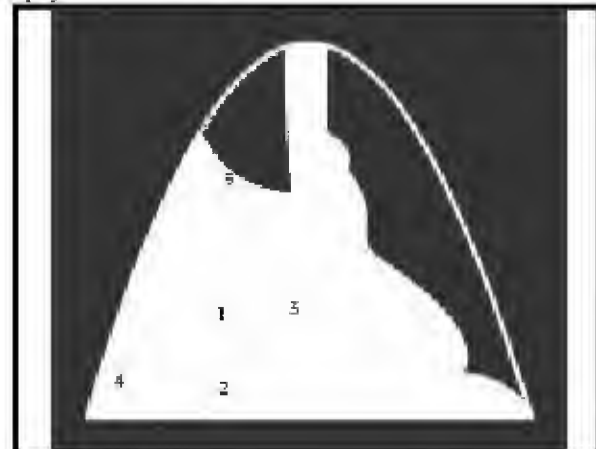
#### • Criteria:

##### - Basal homogenous opacity:

1. Obliterating BOTH Diaphragmatic & Mediastinal borders.
2. Obliterating Costophrenic angle.
3. With well-defined upper concave border.

#### • Exception:

1. If the pleural effusion is Transudative, ribs may be seen at Costophrenic angle. However, diaphragmatic border is **NOT sharply well-defined**; indicating pleural effusion.
2. Sometimes, heterogenous opacity (fluffy cotton or nodular shadow) may mask the upper concave border of pleural effusion, so **depend on other criteria of pleural effusion**.



**Diagram 44**

#### Pleural effusion

1. Basal homogenous opacity
2. Obliterating diaphragmatic border
3. Obliterating mediastinal border
4. Obliterating costophrenic angle
5. Well defined upper concave border

#### • Classic picture of pleural effusion (Heart failure):

- Cardiomegally.
- Right-sided pleural effusion.
- Ground glass opacity in upper lung field.

### ▪ Causes of obliterated Costophrenic angle (other than pleural effusion):

- Lower lobar:      • Collapse.      • Consolidation.      • Fibrosis.

However, they lack other criteria of pleural effusion.

## 6. With fluid level:

### ▪ Possibilities:

#### 1. Hydropneumothorax:

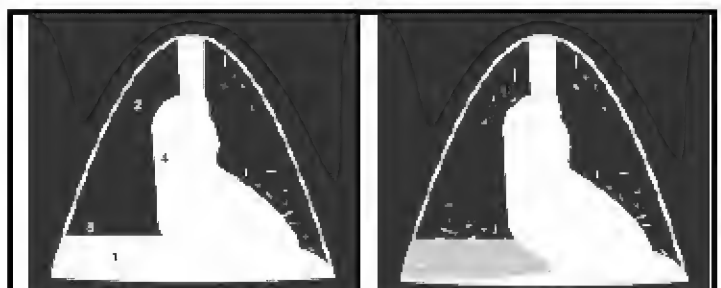
#### • Criteria:

- i. Upper part of lung field; as Pneumothorax.
- ii. Lower part of lung field; as pleural effusion.

#### • Special condition:

##### Encysted Hydropneumothorax

- opacity with a fluid level is present, so **HYDROPNEUMOTHORAX** but:
  - i. Upper part of lung field contains intra Pulmonary vascular markings (**NOT Jet Black**).
  - ii. Lower part of lung field contains **LIGHT** opacity.



**Diagram 45**

#### Hydropneumothorax

1. pleural effusion
2. pneumothorax
3. fluid level
4. collapsed lung

**Diagram 46**

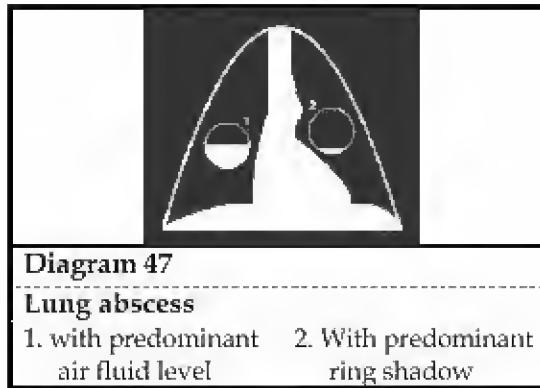
#### Encysted

- hydropneumothorax:
1. Lower part: light opacity
  2. upper part: **NOT jet black** But still fluid level



## 2. Lung abscess:

- **Criteria:**
  - Ring shadow with air-fluid level.
- **Different shapes: with predominant:**
  - Ring: so put differential diagnosis of ring including abscess.
  - Air-fluid level: so put diagnosis as abscess.



## ❖ Heterogenous opacity:

- **How to differentiate between normal lung field & heterogenous opacity?**
  - **By SEVERITY of the opacity:**
    - \*If severe clear, so it is opacity.
    - \*If border line, so depend on Silhouette sign:
      - If the opacity:
        - Causes **haziness** of Mediastinal & Diaphragmatic borders → **Heterogenous opacity.**
        - Is associated with **clear** Mediastinal & Diaphragmatic borders → **Mostly Normal Lung Field.**

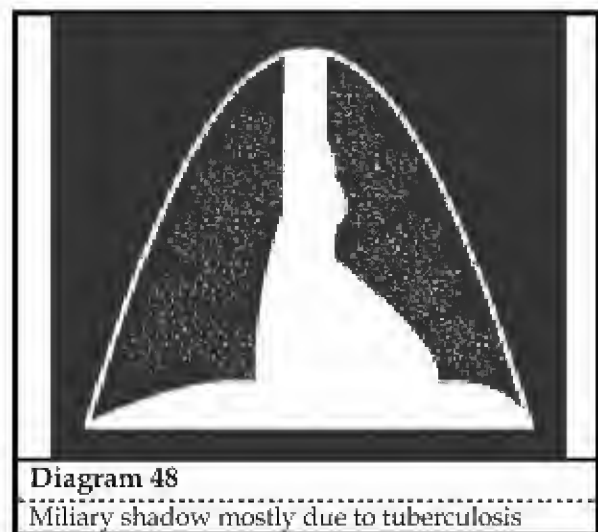
### 1. Linear shadow.

### 2. Miliary shadow:

- **Criteria:**
  - Small 2-5 mm rounded multiple opacities with **UNIFORM** size, density & number.
- **Differential Diagnosis from normal intrapulmonary vascular markings:**

**Intrapulmonary vascular markings:**

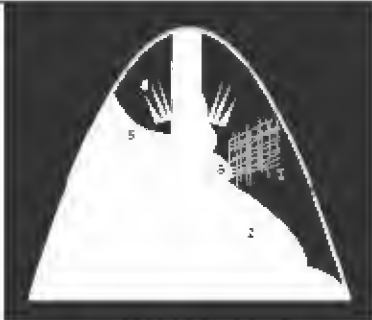
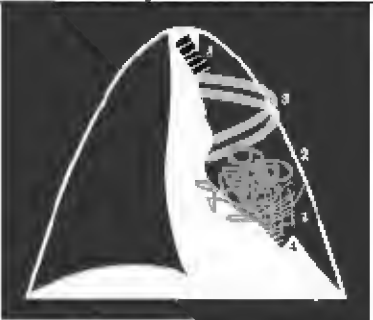

  - Decrease in size & density toward periphery.
  - Increase in number toward periphery.
- **Significance:**
  - Most probably Miliary Tuberculosis.
  - Other causes include:
    - Sarcoidosis.
    - Pneumoconiosis.
    - Miliary metastasis.



### 3. Reticular or Reticular-nodular:

- **Criteria:**
  - **Reticular:** net-like heterogenous opacity.
  - **Reticulonodular:** dot-like heterogenous opacity.

▪ **Types & possibilities:**

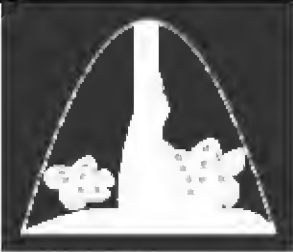



Table	Types & Possibilities of Reticulonodular shadow		
Types	1. Fine (Ground Glass) عيونه صغيرة , مبيض , زجاج مصفر	2. Coarse (Honey Coomb) عيونه كبيرة	
Associated Signs	i. Ground glass ii. Cardiomegally iii. Moustache sign. iv. Mitralization. v. Pleural effusion.	i. Ground glass ii. Honey coomb iii. Signs of Volume loss. iv. Tinting of diaphragm. v. Mediastinal shift to the same side. vi. Pulmonary Hypertension. vii. Bilateral & Symmetrical Shadows.	-Bilateral & Basal.
			
	Diagram 49	Diagram 50	Diagram 51
Diagnosis	Interstitial pulmonary edema (With Heart Failure).	Interstitial Lung fibrosis.	Bronchiectasis.

**4. Fluffy Cotton:**



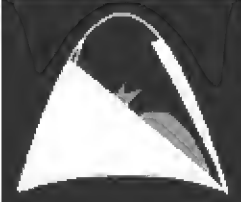
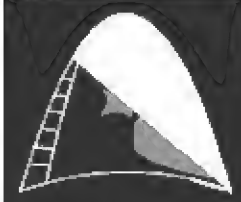
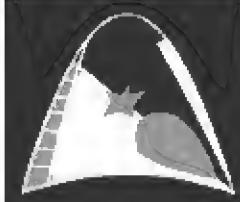

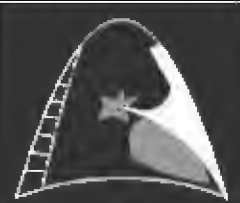
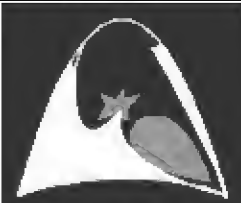









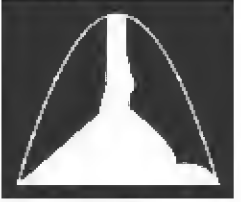


- **Criteria:** بوطشة بيضة Patch of White opacity with ill defined border ± air bronchogram.
- **Differential Diagnosis:**

Fluffy Cotton	Ground Glass	Coin Shadow
ابيض	مبيضة	ابيض
Ill defined.	Ill defined.	Well defined.

▪ **Scheme & Possibilities:**

Table	Scheme & Possibilities for Fluffy Cotton opacity			
	Bibasal Asymmetrical	Apical	Single	Bat wing appearance
				
	Diagram 52	Diagram 53	Diagram 54	Diagram 55
Diagnosis	Broncho-pneumonia.	• Tuberculosis. • Friedlander's Bronchopneumonia.	Pneumonic Patch.	Alveolar Pulmonary Edema.

**Table** Lobar consolidation and collapse

		Right lung			Left lung	
		Upper lobe	Middle lobe	Lower lobe	Upper lobe	Lower lobe
Lateral view	Pneumonia					
		Diagram 56	Diagram 57	Diagram 58	Diagram 59	Diagram 60
Lateral view	Collapse					
		Diagram 61	Diagram 62	Diagram 63	Diagram 64	Diagram 65
Posteroanterior view	Pneumonia					
		Diagram 66	Diagram 67	Diagram 68	Diagram 69	Diagram 70
Posteroanterior view	Collapse					
		Diagram 71	Diagram 72	Diagram 73	Diagram 74	Diagram 75

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